# Investigation of antibacterial properties of ultrafiltration polymeric membranes

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The aim of this study was to investigate the effect of the chemical nature of the membranes surface on their biofouling. To obtain composite membranes with different chemical nature of the surface, a method of photoinitiated graft polymerization was used. Antibacterial properties of synthesized membranes were evaluated with *Escherichia coli (E. coli*) suspension, which was prepared by the method described previously [1].

Microfiltration polyethersulphone and polyvilidenefluoride membranes with an average pore size of 0.22 μm (Millipore Express and Millipore Durapore) have been used in the study. 2-acrylamide-2-methyl-1-propansulfonic acid (AMPS), 2 hydroxyethylmetacrylate (HEME) and quaternized 2- (dimethylamino) ethyl methacrylate (kDMAEM) were used as modified agents.

The membrane tendency to biofouling has been evaluated during filtration of *E. coli* suspension in a dead-end membrane cell with an effective membrane area of 24.6 $cm^2$. The operating pressure was created by compressed nitrogen. The rotation speed in the membrane cell was set as 300 ± 20 r/min. The membrane flux was determined as:

$$J = V / S\,\tau,$$

where $J$ is membrane flux ($dm^3/m^2h$), $V$ is permeate volume ($dm^3$) passed through the membrane area of $S$ ($m^2$) during filtration time of $\tau$ (h) at operating pressure of $\Delta P$ (bar).

The results of microbiological tests reveal that the membranes modified with kDMAEM possess a strong bactericidal effect. AMPS modified membranes showed much weaker antibacterial properties, while HEME modified membranes practically did not exhibit any bactericidal action.

The performed studies have also shown that the mechanism of antimicrobial action of the obtained composite membrane was probably similar to the same for guanidine substances [2]. It was found that the surface chemistry of the composite membranes essentially affects their susceptibility to biofouling. The membranes with hydrophilic surface were less fouled with *E.coli* cells comparing with hydrophobic membranes while the ability to recover the membrane flux upon washing was higher for the membranes with a chemically neutral surface than for charged membranes.

Thus, targeted chemical modification of the membrane surface can increase the membrane resistance to biofouling, especially when aqueous solutions with low concentrations of foulants are used for filtration.

**References**

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